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October 1, 1998

Assistant Commissioner for Patents
Washington, D.C. 20231

Re: New Patent Application
Inventor(s): Miki MULLOR and Julian VALIKO
Attorney Docket: REINC 4237.01

Sir:

Please find attached hereto an application for patent which includes:

Specification, Claims, Declaration, Power of Attorney.

A certified copy of Israel Application No. 124571 filed May 21, 1998, the priority of which is claimed herewith under 35 U.S.C. 119.

Verified Declaration Statement showing Small Entity Status:

Formal Drawings: Figures 1 and 2 (2 sheets)

Fee (see formula below) check enclosed.

Basic Fee \$395/790..... \$ 395.00

Additional Fees:

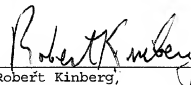
Total number of claims in excess of 20 *times \$11/22 \$ 0.00

Number of independent claims 1
in excess of 3: *times \$41/82..... \$ 0.00

An assignment is likewise enclosed; Recording Fee \$40. 40.00
TOTAL FEES FOR THE ABOVE APPLICATION... \$ 435.00

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Respectfully submitted


Robert Kinberg,
Registration No. 26,924

RK:boa

Applicant or Patentee: _____

Serial or Patent No.: _____

Filed or Issued: _____

For: METHOD OF RESTRICTING SOFTWARE OPERATION WITHIN A LICENSED LIMITATION

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) and 1.27(c)) - SMALL BUSINESS CONCERN

I hereby declare that I am

☐ the owner of the small business concern identified below:

☒ an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN M.Y.P.D. TECHNOLOGIES LTD.

ADDRESS OF CONCERN c/o Keren-Shechter Law Firm, 21 Har Sinai Street,
Tel-Aviv 65816, Israel

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention, entitled METHOD OF RESTRICTING SOFTWARE OPERATION WITHIN A LICENSED LIMITATION inventor(s) Miki MULLOR and Julian VALIKO

described in

☒ the application filed herewith

☐ application serial no. _____, filed _____

☐ patent no. _____, issued _____

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed below* and no rights to the invention are held by any person, other than the inventor, who could not qualify as a small business concern under 37 CFR 1.9(d) or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e). *NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averting to their status as small entities. (37 CFR 1.27)

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I acknowledge the duty to file, in this application or patent, notification of any change of status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING X MIKI MULLOR

TITLE OF PERSON SIGNING X manager

ADDRESS OF PERSON SIGNING X 3 Zeeva Kanat-Hashron

SIGNATURE X [Signature]

DATE 11/2/98

Method of Restricting Software Operation within A License Limitation

FIELD OF THE INVENTION

This invention relates to a method and system of identifying and restricting an unauthorized software program's operation.

BACKGROUND OF THE INVENTION

5 Numerous methods have been devised for the identifying and restricting of unauthorized software program's operation. These methods have been primarily motivated by the grand proliferation of illegally copied software, which is engulfing the marketplace. This illegal copying represents billions of dollars in lost profits to commercial software developers.

10 Software based products have been developed to validate authorized software usage by writing a license signature onto the computer's volatile memory (e.g. hard disk). These products may be appropriate for restricting honest software users, but they are very vulnerable to attack at the hands of skilled system's programmers (e.g. "hackers"). These license signatures are
15 also subject to the physical instabilities of their volatile memory media.

Hardware base products have also been developed to validate authorized software usage by accessing a dongle that is coupled e.g. to the parallel port of the P.C. These units are expensive, inconvenient, and not particularly suitable for software that may be sold by downloading (e.g. over
20 the internet).

There is accordingly a need in the art to provide for a system and method that substantially reduce or overcome the drawbacks of hitherto known solutions.

5 SUMMARY OF THE INVENTION

The present invention relates to a method of restricting software operation within a license limitation. This method strongly relies on the use of a key and of a record, which have been written into the non-volatile memory of a computer.

10 For a better understanding of the underlying concept of the invention, there follows a specific non-limiting example. Thus, consider a conventional computer having a conventional BIOS module in which a key was embedded at the ROM section thereof, during manufacture. The key constitutes, effectively, a unique identification code for the host computer. It is important
15 to note that the key is stored in a non-volatile portion of the BIOS, i.e. it cannot be removed or modified.

Further, according to the invention, each application program that is to be licensed to run on the specified computer, is associated with a license record; that consists of author name, program name and number of licensed
20 users (for network). The license record may be held in either encrypted or explicit form.

Now, there commences an initial license establishment procedure, where a verification structure is set in the BIOS so as to indicate that the specified program is licensed to run on the specified computer. This is
25 implemented by encrypting the license record (or portion thereof) using said key (or portion thereof) exclusively or in conjunction with other identification information) as an encryption key. The resulting encrypted license record is stored in another (second) non-volatile section of the BIOS, e.g. E²PROM (or

the ROM). It should be noted that unlike the first non-volatile section, the data in the second non-volatile memory may optionally be erased or modified (using E²PROM manipulation commands), so as to enable to add, modify or remove licenses. The actual format of the license may include a string of terms that correspond to a license registration entry (e.g. lookup table entry or entries) at a license registration bureau (which will be further described as part of the preferred embodiment of the present invention).

Having placed the encrypted license record in the second non-volatile memory (e.g. the E²PROM), the process of verifying a license may be commenced. Thus, when a program is loaded into the memory of the computer, a so called license verifier application, that is *a priori* running in the computer, accesses the program under question, retrieves therefrom the license record, encrypts the record utilizing the specified unique key (as retrieved from the ROM section of the BIOS) and compares the so encrypted record to the encrypted records that reside in the E²PROM. In the case of match, the program is verified to run on the computer. If on the other hand the sought encrypted data record is not found in the E²PROM database, this means that the program under question is not properly licensed and appropriate application define action is invoked (e.g. informing to the user on the unlicensed status, halting the operation of the program under question etc.)

Those versed in the art will readily appreciate that any attempt to run a program at an unlicensed site will be immediately detected. Consider, for example, that a given application, say Lotus 123, is verified to run on a given computer having a first identification code (k1) stored in the ROM portion of the BIOS thereof. This obviously requires that the license record (LR) of the application after having been encrypted using k1 giving rise to (LR)_{k1} is stored in the E²PROM of the first computer.

Suppose now that a hacker attempts to run the specified application in a second computer having a second identification code (k2) stored in the

ROM portion of the BIOS thereof. All or a portion the database contents (including of course $(LR)_{k1}$) that reside in the E²PROM portion in the first computer may be copied in a known *per se* means to the second computer. It is important to note that the hacker is unable to modify the key in the ROM of the second computer to $K1$, since, as recalled, the contents of the ROM is established during manufacture and is practically invariable.

Now, when the application under question is executed in the second computer, the license verifier retrieves said LR from the application and, as explained above, encrypts it using the key as retrieved from the ROM of the second computer, i.e. $k2$ giving rise to encrypted license record $(LR)_{k2}$. Obviously, the value $(LR)_{k2}$ does not reside in the E²PROM database section of the second computer (since it was not legitimately licensed) and therefore the specified application is invalidated. It goes without saying that the data copied from the first (legitimate) computer is rendered useless, since comparing $(LR)_{k2}$ with the copied value $(LR)_{k1}$ results, of course, in mismatch.

The example above is given for clarity of explanation only and is by no means binding.

In its broadest aspect, the invention provides for a method of restricting software operation within a license limitation including; for a computer having a first non-volatile memory area, a second non-volatile memory area, and a volatile memory area; the steps of: selecting a program residing in the volatile memory, setting up a verification structure in the non-volatile memories, verifying the program using the structure, and acting on the program according to the verification.

An important advantage in utilizing non-volatile memory such as that residing in the BIOS is that the required level of system programming expertise that is necessary to intercept or modify commands, interacting with the BIOS, is substantially higher than those needed for tampering with data

residing in volatile memory such as hard disk. Furthermore, there is a much higher cost to the programmer, if his tampering is unsuccessful, i.e. if data residing in the BIOS (which is necessary for the computer's operability) is inadvertently changed by the hacker. This is too high of a risk for the ordinary software hacker to pay. Note that various recognized means for hindering the professional-like hacker may also be utilized (e.g. anti-debuggers, etc.) in conjunction with the present invention.

In the context of the present invention, a "computer" relates to a digital data processor. These processors are found in personal computers, or on one or more processing cards in multi-processor machines. Today, a processor normally includes a first non-volatile memory, a second non-volatile memory, and data linkage access to a volatile memory. There are also processors having only one non-volatile memory or having more than two non-volatile memories; all of which should be considered logically as relating to having a first and a second non-volatile memory areas. There are also computational environments where the volatile memory is distributed into numerous physical components, using a bus, LAN, etc.; all of which should logically be considered as being a volatile memory area.

According to the preferred embodiment of the present invention, there is further provided a license authentication bureau which can participate in either or both of:

(i) establishing the license record in the second non-volatile memory; and

(ii) verifying if the key and license record in the non-volatile memory(s) is compatible with the license record information as extracted from the application under question.

The bureau is a telecommunications accessible processor where functions such as formatting, encrypting, and verifying may be performed. Performing these or other functions at the bureau helps to limit the

understanding of potential software hackers; since they can not observe how these functions are constructed. Additional security may also be achieved by forcing users of the bureau to register, collecting costs for connection to the bureau, logging transactions at the bureau, etc.

- 5 According to one example of using the bureau, setting up a verification structure further includes the steps of: establishing, between the computer and the bureau, a two-way data-communications linkage; transferring, from the computer to the bureau, a request-for-license including an identification of the computer and the license-record's contents from the selected program;
- 10 forming an encrypted license-record at the bureau by encrypting parts of the request-for-license using part of the identification as the encryption key; and transferring, from the bureau to the computer, the encrypted license-record.

- According to another example of using the bureau, verifying the program further includes the steps of: establishing, between the computer and
- 15 the bureau, a two-way data-communications linkage; transferring, from the computer to the bureau, a request-for-license-verification including an identification of the computer, the encrypted license-record for the selected program from the second non-volatile memory, and the licensed-software-program's license-record contents; enabling the comparing
- 20 at the bureau; and transferring, from the bureau to the computer, the result of the comparing.

- The actual key that serves for identifying the computer may be composed of the pseudo-unique key exclusively, or, if desired, in combination with information, e.g. information related to the registration of the user such
- 25 as e.g. place, telephone number, user name, license number, etc. In the context of the present invention, a "pseudo-unique" key may relate to a bit string which uniquely identifies each first non-volatile memory. Alternately the "pseudo-unique" key may relate to a random bit string (or to an assigned bit string) of sufficient length such that: there is an acceptably low probability of

a successful unauthorized transfer of licensed software between two computers, where the first volatile memories of these two computers have the same key.

It should be noted that the license bureau might maintain a registry of
5 keys and of licensed programs that have been registered at the bureau in association with these keys. This registry may be used to help facilitate the formalization of procedures for the transfer of ownership of licensed software from use on one computer to use on another computer.

Constructing the key in the manner specified may hinder the hacker in
10 cracking the proposed encryption scheme of the invention, in particular when the establishment of the license record or the verification thereof is performed in the bureau. Those versed in the art will readily appreciate that the invention is by no means bound by the data, the algorithms, or the manner of operation of the bureau. It should be noted that the tasks of establishing and/or verifying
15 a license record may be shared between the bureau and the computer, done exclusively at the computer, or done exclusively at the bureau. The pseudo-unique key length needs to be long enough to hinder encryption attack schemes. The establishing of the key may be done at any time from the non-volatile memory's manufacture until an attempted use of an established
20 license-record in the non-volatile memory. The key is used for encryption or decryption operations associated with license-records. In principle, the manufacturer of the licensed-software-program may specify the license-record format and therefore different formats may, if desired, be used for respective applications.

25 According to the preferred embodiment of the present invention, the pseudo-unique key is a unique-identification bit string that is written onto the first non-volatile memory by the manufacturer of the is memory media.

According to one, non-limiting, preferred embodiment of the present invention, the first non-volatile memory area is a ROM section of a BIOS; the

second non-volatile memory area is a E²PROM section of a BIOS; and the volatile memory is a RAM e.g. hard disk and/or internal memory of the computer .

The present invention also relates to a non-volatile memory media
5 used as a BIOS of a computer, for restricting software operation within a license limitation, wherein a pseudo-unique key is established.

According to the preferred embodiment of the non-volatile memory media of the present invention, the pseudo-unique key is established in a ROM section of the BIOS.

10

BRIEF DESCRIPTION OF THE DRAWINGS:

In order to understand the invention and to see how it may be carried out in practice, a preferred embodiment will now be described, by way of non-limiting example only, with reference to the accompanying drawings, in
15 which:

Fig. 1 is a schematic diagram of a computer and a license bureau; and

Fig. 2 is a generalized flow chart of the sequence of operations performed according to one embodiment of the invention.

20 DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

A schematic diagram of a computer and a license bureau is shown in Figure 1. Thus, a computer processor (1) is associated with input operations (2) and with output operations (3). This computer (processor) internally contains a first non-volatile memory area (4) (e.g. the ROM section of the BIOS), a second non-volatile memory area (5) (e.g. the E²PROM section of
25 the BIOS), and a volatile memory area (6) (e.g. the internal RAM memory of the computer).

The computer processor is in temporary telecommunications linkage with a license bureau (7).

The first non-volatile memory includes a pseudo-random identification key (8), which exclusively or in combination with other information (e.g. user name), is sufficient to uniquely differentiate this first non-volatile memory from all other first non-volatile memories. As specified before, said key constitutes unique identification of the computer.

The second non-volatile memory includes a license-record-area (9) e.g. for the containing of at least one encrypted license-record (e.g. three records 10-12). The volatile memory accommodates a license program (16) having license record fields (13-15) appended thereto. By way of example said fields stand for Application name (e.g. Lotus 123), Vendor name (Lotus inc.), and no of licensed copies (1 for stand alone usage, >1 for number of licensed users for a network application).

Those versed in the art will readily appreciate that the license record is not necessarily bound to continuous fields. In fact, the various license content components of the data record may be embedded in various locations in the application. Any component may, if desired, be encrypted.

Each one of the encrypted license records (10-12) is obtained by encrypting the corresponding license record as extracted from program 16, utilizing for encryption the identification key (8).

In a typical, yet not exclusive, sequence of operation, a transaction/request is sent, by the computer to the bureau. This transaction includes the key (8), the encrypted license-records (10-12), contents from the license program used in forming a license record (e.g. fields 13-15), and other items of information as desired.

The bureau forms the proposed license-record from the contents, encrypts (utilizing predetermined encryption algorithm) the so formed license-record using the key (8), and compares the so formed encrypted

license-record with the license-records (10-12). The bureau generates an overlay according to the result of the comparison indication successful comparison, non-critical failure comparison and critical failure comparison.

The bureau returns the overlay which will direct the computer in
5 subsequent operation. Thus, a success overlay will allow the license program to operate. A non-critical failure overlay will ask for additional user interactions. A critical failure overlay will cause permanent disruption to the computer's BIOS operations. Thus, software operation of the program is methodologically according to a license limitation restriction.

10 Those versed in the art will readily appreciate that the implementation as described with reference to Fig. 1 is by no means binding. Thus, by way of non-limiting example, the bureau, instead of being external entity may form part of the computer.

Attention is now directed to Fig. 2, showing a generalized flow chart
15 of the sequence of operations performed according to one embodiment of the invention.

Thus, selecting (17) a program includes the step of: establishing a licensed-software-program in the volatile memory of the computer wherein the licensed-software-program includes contents used to form a
20 license-record. These contents, be they centralize or decentralized, may include terms, identifications, specifications, or limitations related to the manufacturer of a software product, the distributor of a software product, the purchaser of a software product, a licensor, a licensee, items of computer hardware or components thereof, or to other terms and conditions related to
25 the aforesaid.

Setting up (18) the verification structure includes the steps of: establishing or certifying the existence of a pseudo-unique key in the first non-volatile memory area; and establishing at least one license-record location in the first or the second nonvolatile memory area.

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Establishing a license-record includes the steps of: forming a license-record by encrypting of the contents used to form a license-record with other predetermined data contents, using the key; and establishing the encrypted license-record in one of the at least one established license-record locations (e.g. 10-12 in Figure 1).

Verifying (19) the program includes the steps of: encrypting the licensed-software-program's license-record contents from the volatile memory area or decrypting the license-record in the first or the second non-volatile memory area, using the key; and comparing the encrypted licensed-software-program's license-record contents with the encrypted license-record in the first or the second non-volatile memory area, or comparing the licensed-software-program's license-record contents with the decrypted license-record in the first or the second non-volatile memory area.

Acting (20) on the program includes the step of: restricting the program's operation with predetermined limitations if the comparing yields non-unity or insufficiency. In this context "non-unity" relates to being unequal with respect to a specific equation (e.g. $A=B+1$); and "insufficiency" relates to being outside of a relational bound (e.g. $A>B+1$). "Restricting the program's operation with predetermined limitations" may include actions such as erasing the software in volatile memory, warning the license applicant/user, placing a fine on the applicant/user through the billing service charges collected at the license bureau (if applicable), or scrambling sections of the BIOS of the computer (or of functions interacting therewith).

The present invention has been described with a certain degree of particularity but it should be understood that various modifications and alterations may be made without departing from the scope or spirit of the invention as defined by the following claims:

CLAIMS:

1. A method of restricting software operation within a license limitation comprising; for a computer having a first non-volatile memory area, a second non-volatile memory area, and a volatile memory area; the steps of:
 - 5 selecting a program residing in the volatile memory, setting up a verification structure in the non-volatile memories, verifying the program using the structure, and acting on the program according to the verification.
2. A method according to claim 1, further comprising the step of: establishing a license authentication bureau.
- 10 3. A method according to claim 2, wherein setting up a verification structure further comprising the steps of: establishing, between the computer and the bureau, a two-way data-communications linkage; transferring, from the computer to the bureau, a request-for-license including an identification of the computer and the license-record's contents from the selected program;
 - 15 forming an encrypted license-record at the bureau by encrypting parts of the request-for-license using part of the identification as the encryption key; and transferring, from the bureau to the computer, the encrypted license-record.
4. A method according to claim 2, wherein verifying the program further comprising the steps of: establishing, between the computer and the bureau, a two-way data-communications linkage; transferring, from the computer to the bureau, a request-for-license-verification including an identification of the computer, the encrypted license-record for the selected program from the second non-volatile memory, and the licensed-software-program's license-record contents; enabling the comparing
 - 20 at the bureau; and transferring, from the bureau to the computer, the result of the comparing.
5. A method according to claim 3 wherein the identification of the computer includes the pseudo-unique key.

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6. A method according to claim 1 wherein selecting a program includes the step of: establishing a licensed-software-program in the volatile memory of the computer wherein said licensed-software-program includes contents used to form a license-record.

5 7. A method according to claim 1 wherein setting up the verification structure includes the steps of: establishing or certifying the existence of a pseudo-unique key in the first non-volatile memory area; and establishing at least one license-record location in the first or the second nonvolatile memory area.

10 8. A method according to claim 6 wherein establishing a license-record includes the steps of: forming a license-record by encrypting of the contents used to form a license-record with other predetermined data contents, using the key; and establishing the encrypted license-record in one of the at least one established license-record locations.

15 9. A method according to claim 1 wherein verifying the program includes the steps of: encrypting the licensed-software-program's license-record contents from the volatile memory area or decrypting the license-record in the first or the second non-volatile memory area, using the key; and comparing the encrypted licensed-software-program's license-record
20 contents with the encrypted license-record in the first or the second non-volatile memory area, or comparing the licensed-software-program's license-record contents with the decrypted license-record in the first or the second non-volatile memory area.

25 10. A method according to claim 1 wherein acting on the program includes the step of: restricting the program's operation with predetermined limitations if the comparing yields non-unity or insufficiency.

11. A method according to claim 1 wherein the first non-volatile memory area is a ROM section of a BIOS.

12. A method according to claim 1 wherein the second non-volatile memory area is a E²PROM section of a BIOS.

13. A method according to claim 1 wherein the volatile memory is a RAM.

5 14. A non-volatile memory media used as a BIOS of a computer, for restricting software operation within a license limitation, wherein a pseudo-unique key is established.

15. A non-volatile memory media according to claim 14 wherein the pseudo-unique key is established in a ROM section of the BIOS.

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ABSTRACT

A method of restricting software operation within a license limitation that is applicable for a computer having a first non-volatile memory area, a
5 second non-volatile memory area, and a volatile memory area. The method includes the steps of selecting a program residing in the volatile memory, setting up a verification structure in the non-volatile memories, verifying the program using the structure, and acting on the program according to the verification.

10

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As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name, and that I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Method of Restricting Software Operation within a Licensed Limitation
the specification of which

[☒] is attached hereto.

[] was filed on _____ as Application No. --Unknown--
and was amended on _____ [if applicable].

[] was filed under the Patent Cooperation Treaty on _____
Serial No. _____, the United States of America being designated.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent, utility model, design or inventor's certificate listed below and have also identified below any foreign application(s) for patent, utility model, design or inventor's certificate having a filing date before that of the application(s) on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed	
Number	Country	Date Filed	Yes	No
124571	Israel	May 21, 1998	X	

I hereby appoint the following attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith: George H. Spencer (Reg. No. 18,038), Norman N. Kunitz (Reg. No. 20,586), Robert J. Frank (Reg. No. 19,112), Gabor J. Kelemen (Reg. No. 21,016), Robert Kinberg (Reg. No. 26,924), John W. Schneller (Reg. No. 26,031), Ashley J. Wells (Reg. No. 29,847), Christopher H. Lynt (Reg. No. 33,619) Suite 300 East, 1100 New York Avenue, N.W., Washington, D.C. 20005-3955, Telephone: (202) 414-4000, Telefax: (202) 414-4040. Address all correspondence to SPENCER & FRANK, Suite 300 East, 1100 New York Ave., N.W., Washington, D.C. 20005-3955.

The undersigned hereby authorizes the U.S. attorneys named herein to accept and follow instructions from the undersigned's assignee, if any, and/or, if the undersigned is not a resident of the United States, the undersigned's domestic attorney, patent attorney or patent agent, as to any action to be taken in the Patent and Trademark Office regarding this application without direct communication between the U.S. attorneys and the undersigned. In the event of a change in the person(s) from whom instructions may be taken, the U.S. attorneys named herein will be so notified by the undersigned.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Signature: X [Signature] Date: X 8/28/98, 1998.

Sole/First Inventor: Miki Mullor

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Signature: X [Signature] Date: X 6/28/98, 1998.

Second Inventor: Julian Valiko

Citizenship: Israeli

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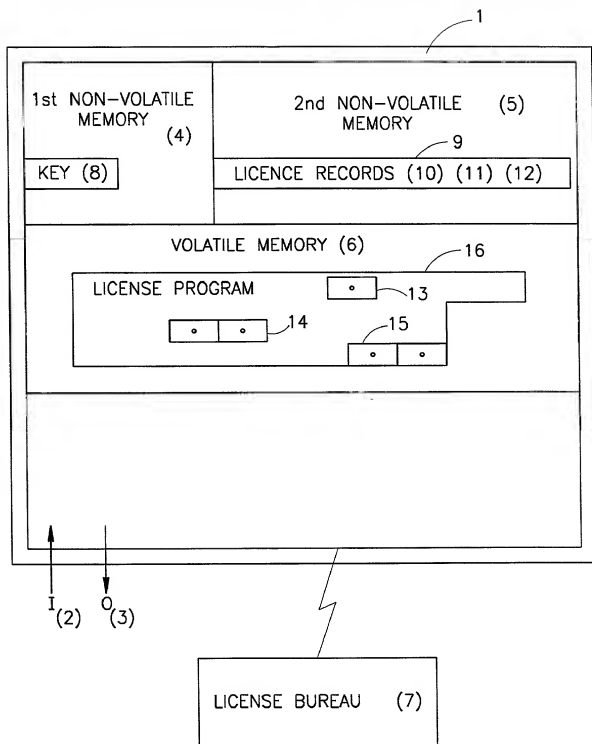


FIG.1

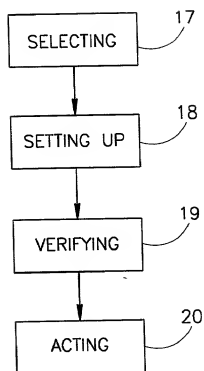


FIG.2